

# CHAPTER X

## USE OF COMPUTER BASED TRAINING FOR AIRCRAFT INSPECTION: MINIMIZING ERRORS AND STANDARDIZING THE INSPECTION PROCESS

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### X.1 INTRODUCTION

The Chapter is divided into three major sections. The first section provides the background information on the development of the Automated System of Self-Instruction for Specialized Training (**ASSIST**)—a computer based training tool for aircraft inspection. The section describes how previous years research efforts guided the development of the **ASSIST** program. The second section provides a brief description of the **ASSIST** program and the final section outlines the conclusions with recommendations for future research. The research was jointly pursued with two industry partners – Delta Air Lines, Atlanta, GA and Lockheed Martin Aircraft Center, Greenville, SC to ensure that it was relevant and addressed the needs of the aviation community. The **ASSIST** software package is available from Galaxy Scientific Corporation.

### X.2 BACKGROUND

The aircraft inspection/maintenance system is a complex one with many interrelated human and machine components.<sup>1,2</sup> The linchpin of this system, however, is the human. Recognizing this, the Federal Aviation Administration (**FAA**), under the auspices of the National Plan for Aviation Human Factors, has pursued human factors research. In the maintenance area this research had focused on the aviation maintenance technician (**AMT**). Since it is difficult to eliminate errors altogether, continuing emphasis must be placed on developing interventions to make inspection and maintenance more reliable and/or more error tolerant. Inspection is affected by a variety of entities. These entities include large international carriers, regional and commuter airlines, repair and maintenance facilities, as well as the fixed-based operators associated with general aviation. An effective inspection is seen as a necessary prerequisite to public safety, so both inspection and maintenance procedures are regulated by the U.S. federal government via the **FAA**. Investigators conducting this study found that, while adherence to inspection procedures and protocols is relatively easy to monitor, tracking the efficacy of these procedures is not.

#### X.2.1 The Aircraft Maintenance Process

The maintenance process begins when a team that includes representatives from the **FAA**, aircraft manufacturers, and start-up operators schedule the maintenance for a particular aircraft. This initial process is called the Maintenance Review Board (**MRB**). These schedules may be, and often are, later

modified by individual carriers to suit their own scheduling requirements. These maintenance schedules are comprised of a variety of checks that must be conducted at various intervals. Such checks or inspections include flight line checks, overnight checks, and four different inspections of increasing thoroughness, the A, B, C, and the most thorough and most time-consuming, D check. In each of these inspections, the inspector checks both the routine and non-routine maintenance of the aircraft. If a defect is discovered during one of these inspections, the necessary repairs are scheduled. Following these inspections, maintenance is scheduled to 1) repair known problems, 2) replace items because the prescribed amount of air time, number of cycles, or calendar time has elapsed, 3) repair previously documented defects (e.g. reports logged by pilot and crew, line inspection, or items deferred from previous maintenance), and 4) perform the scheduled repairs (those scheduled by **MRB**).

In the context of an aging fleet, inspection takes an increasingly vital role. Scheduled repairs to an older fleet account for only 30% of all maintenance compared with the 60-80% in a newer fleet. This difference can be attributed to the increase in the number of age-related defects.<sup>2,3</sup> In such an environment the importance of inspection cannot be overemphasized. It is critical that these visual inspections be performed effectively, efficiently, and consistently over time. Moreover, 90% of all inspection in aircraft maintenance is visual in nature and is conducted by inspectors, thus inspector reliability is fundamental to an effective inspection. As in any system that is highly dependent on human performance, efforts made to reduce human errors by identifying human/system mismatches can have an impact on the overall effectiveness and the efficiency of the system. Given the backdrop of the inspection system, the objective of this particular study was to use training as an intervention strategy to reduce inspection errors.

## **X.2.2 Using Human Factors to Improve Aircraft Inspection Performance**

An analysis of the inspector's role in inspection has pointed to a number of issues (e.g. inspector-oriented issues, environmental design issues, workplace design issues, etc.).<sup>1,4</sup> These issues have been continually addressed by the **FAA**.<sup>3</sup> Research conducted under this program has identified several ergonomic changes to both the system and to the inspector. System changes have included improved work control cards and crew resource management interventions.<sup>5,6</sup> Inspector-oriented interventions are 1) selection and 2) training. The current research concentrates on training and specifically the use of advanced technology for training as an improvement strategy.

## **X.2.3 The Need for Computer-based Inspection Training**

Aircraft inspection and maintenance are an essential part of a safe, reliable air transportation system. Training has been identified as the primary intervention strategy in improving inspection performance. If training is to be successful, it is clear that we need to provide inspectors with training tools to help enhance their inspection skills.

Existing training for inspectors in the aircraft maintenance environment tends to be mostly on-the-job (**OJT**). Nevertheless, this may not be the best method of instruction.<sup>7,8</sup> For example, in **OJT** feedback may be infrequent, unmethodical, and/or delayed. Moreover, in certain instances feedback is economically prohibitive or infeasible due to the nature of the task. Thus, because the benefits of feedback in training have been well documented,<sup>9</sup> and for other reasons as well, alternatives to **OJT** are sought. Furthermore, training for improving visual inspection skills of aircraft inspectors is generally lacking at aircraft repair centers and aircraft maintenance facilities. However, the application of training knowledge to enhance visual inspection skills has been well documented in the manufacturing industry. Training has been

shown to improve the performance of both novice and experienced.<sup>9,10</sup> Visual inspection skills can be taught effectively using representative photographic images showing a wide range of conditions with immediate feedback on the trainee's decision.<sup>9</sup> Using realistic photographic images as a training aid in controlled practice with feedback has also been shown to be superior to only OJT.<sup>11</sup>

Thus, off-line training/retraining with feedback has a role to play in aircraft inspection training. One of the most viable approaches for delivering training given the many constraints and requirements imposed by the aircraft maintenance environment is computer-based training. Computer-based training offers several advantages relative to traditional training approaches; for example, computer-based training is more efficient, facilitates standardization, and supports distance learning. With computer technology becoming cheaper, the future will bring an increased application of advanced technology in training. Over the past decade, instructional technologists have offered numerous technology based training devices with the promise of improved efficiency and effectiveness. These training devices are being applied to a variety of technical training applications. Examples of such technology include computer-based simulation, interactive videodiscs, and other derivatives of computer based applications. Compact disc read only memory (CD-ROM) and Digital Video Interactive (DVI) are two other technologies which will provide us with the "multi-media" training systems of the future. Many of these training delivery systems such as computer aided instruction, computer based multi-media training and intelligent tutoring systems are already being used today, thus ushering in a revolution in training.

In the domain of visual inspection, the earliest efforts to use computers for off-line inspection training were reported by Czaja and Drury.<sup>12</sup> They used keyboard characters to develop a computer simulation of a visual inspection task. Similar simulations have also been used by other researchers to study inspection performance in a laboratory setting. Since these early efforts, Latorella et al. and Gramopadhye, Drury and Sharit have used low fidelity inspection simulators using computer generated images to develop off-line inspection training programs for inspection tasks.<sup>11,13</sup> Similarly, Drury and Chi studied human performance using a high fidelity computer simulation of a printed circuit board inspection.<sup>14</sup> Another domain, which has seen the application of advanced technology, is that of inspection of x-rays for medical practice. In summary, most of the work in the application of advanced technology to inspection training has focused on developing low fidelity simulators for running controlled studies in a laboratory environment. Thus, research efforts need to be extended in order to take full advantage of today's computer technology. Moreover, advanced technology has found limited application for inspection training in the aircraft maintenance environment. Presently, most of the applications of computer technology to training have been restricted to the defense/aviation industry for complex diagnostic tasks. The message is clear: we need more examples of the application of advanced technology to training for inspection tasks that draw upon the principles of training which we already know will work. In this vein, this paper describes a university/industry collaborative research effort to develop an off-line computer based inspection training system for aircraft inspectors. The specific objective of this research was to develop an inspection training system that would help improve the visual search and decision making skills of aircraft inspectors. The computer based inspection training program entitled "Automated System of Self Instruction for Specialized Training" (ASSIST) was developed in cooperation with Lockheed Martin Aircraft Center and Delta Air Lines (Figure 2.1). A brief description of the of the system follows.

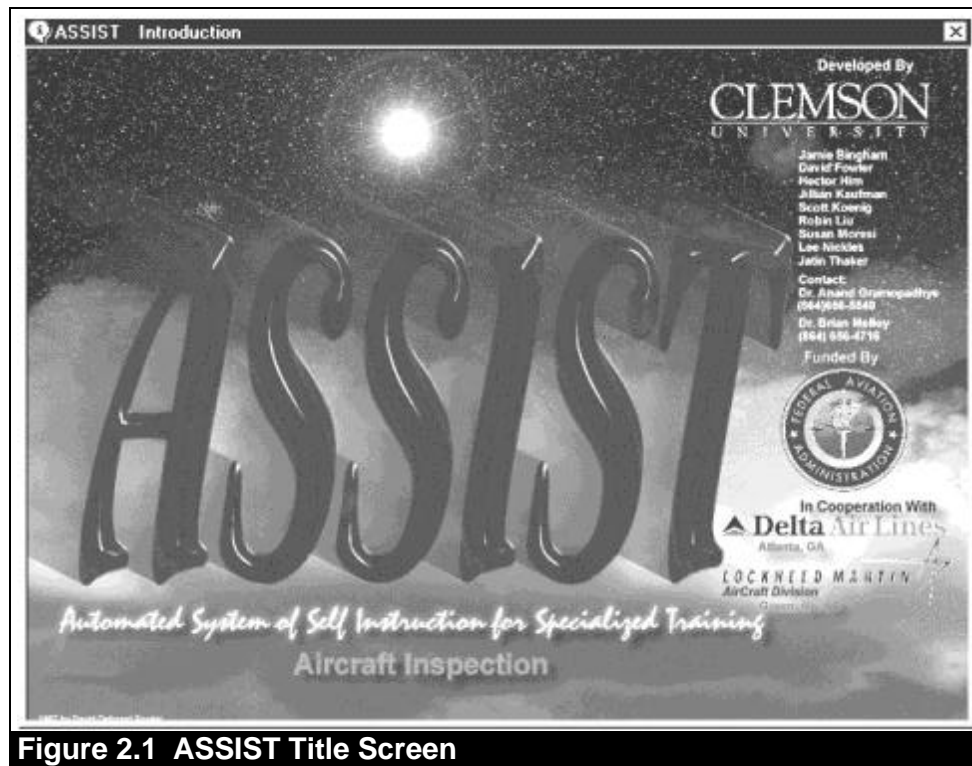
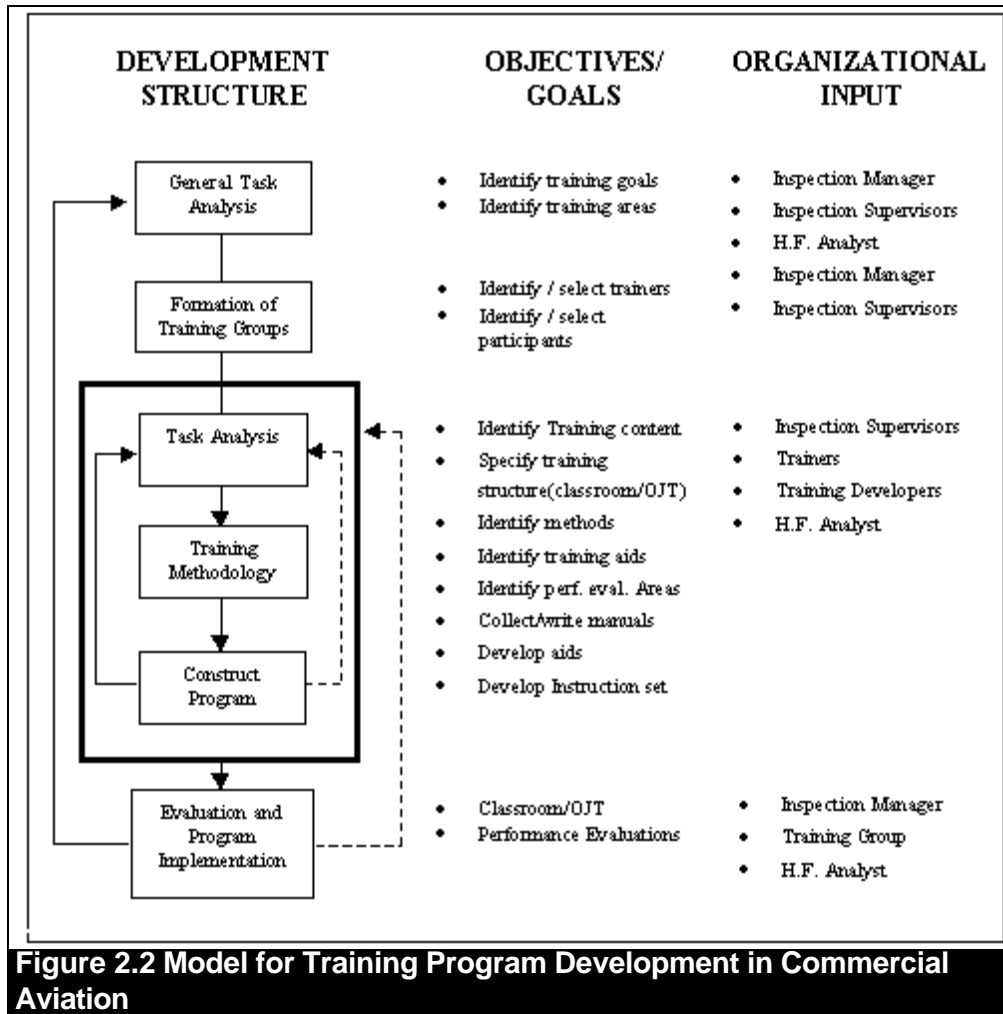


Figure 2.1 ASSIST Title Screen

## X.2.4 Development of the ASSIST program

The development of the ASSIST program followed the classic training program development methodology (Figure 2.2). It began with a thorough analysis of the requirements and needs (goals) of the training program. The task analysis, along with the trainee analysis, were used to compare the knowledge and skills required by the task with those possessed by the inspector to determine gaps which need to be addressed by the training program. Patrick has identified the training content, training methods and trainee as the important constituents of the training program.<sup>15</sup> Drury includes the training delivery system as another component of the training program.<sup>16</sup> Although a considerable amount has been written about designing training systems<sup>8,15</sup> very little focuses directly on enhancement of visual inspection skills. Embrey states that for any training program to be effective, it should address the following three issues: attitude of the trainee at work, knowledge required to perform the job, and the specific skills required to perform the task.<sup>17</sup> Specific training methods incorporated in development of the ASSIST program are described below.<sup>10,18</sup>

1. Pre-training: Pre-training provides the trainee with information concerning the objectives and scope of the training program. During pre-training, pretests can be used to measure (a) the level at which trainees are entering the program and (b) cognitive or perceptual abilities that can later be used to gauge training performance/progress. Advanced organizers or overviews, which are designed to provide the trainee with the basics needed to start the training program, have been found to be useful. The elaboration theory of instruction proposes that training should be imparted in a top-down manner wherein a general level is taught first before proceeding to specifics. Overviews can fulfill this objective by giving the trainee an introduction to the training program and facilitating assimilation of new material.



2. Feedback: A trainee needs rapid, accurate feedback in order to know whether a defect was classified correctly or a search pattern was effective. Some attempt of performing the task followed by feedback with knowledge of results provides a universal method of improving task performance.<sup>9</sup> This applies to learning facts, concepts, procedures, problem solving, cognitive strategies and motor skills. The training program should start with immediate feedback, which should be gradually delayed until the "operational level" is reached. Providing regular feedback beyond the training session will help to keep the inspector calibrated. Gramopadhye, Drury and Prabhu classify feedback as performance and process feedback.<sup>18</sup> Performance feedback on inspection typically consists of information on search times, search errors and decision errors. Process feedback, on the other hand, informs the trainee about the search process, such as areas missed. Another type of feedback called "cognitive feedback" has emerged from the area of social judgement theory. Cognitive feedback is the information provided to the trainee of some measure of the output of his or her cognitive processes. For inspection tasks, process feedback is the same as cognitive feedback.

3. Active Training: In order to keep the trainee involved and to aid in internalizing the material, an active approach is preferred. In active training, the trainee makes an active response after each piece of new material is presented, e.g., identifying a fault type. Czaja and Drury used an active training approach and demonstrated its effectiveness for a complex inspection task.<sup>12</sup>

4. Progressive Parts Training: Salvendy and Seymour successfully applied progressive part training methodology to training industrial skills.<sup>19</sup> In the progressive parts methodology, parts of the job are taught to criterion and then successively larger sequences of parts are taught. For example, if a task consists of four elements E1, E2, E3 and E4, then the following would follow:

- Train E1, E2, E3 and E4 separately to criterion
- Train E1 and E2; E3 and E4 to criterion
- Train E1, E2 and E3 to criterion and E2, E3 and E4 to criterion
- Train the entire task to criterion

This method allows the trainee to understand each element separately as well as the links between the various elements thus representing a higher level of skill. On the other hand, reviews of literature reveal that part task training is not always superior. The choice of whether training should be part or whole task training depends on "cognitive resources" imposed by task elements and the "level of interaction" between individual task elements.<sup>8</sup> Thus, there could be situations in which one type of task training is more appropriate than the other. Naylor and Briggs have postulated that for tasks of relatively high organization or complexity, whole task training should be more efficient than part task training methods.<sup>20</sup>

5. Schema Training: The trainee must be able to generalize the training to new experiences and situations. For example, it is impossible to train the inspector on every site and extent of corrosion in an airframe so that the inspector is able to detect and classify corrosion wherever it occurs. Thus, the inspector will need to develop a "schema" which will allow a correct response to be made in novel situations. The key to the development of schema is to expose the trainee to controlled variability in training.

6. Feedforward Training: It is often necessary to cue the trainee as to what should be perceived. When a novice inspector tries to find defects in an airframe, the indications may not be obvious. The trainee must know what to look for and where to look. Specific techniques within cueing include match-to-sample and delayed match-to-sample. Feedforward information can take different forms such as physical guidance, demonstrations, and verbal guidance. Feedforward should provide the trainee with clear and unambiguous information, which can be translated into improved performance.

The **ASSIST** training program was based on a detailed taxonomy of errors and developed from the failure modes of each task in aircraft inspection. This taxonomy,<sup>7</sup> based on the failure modes and effects analysis (FMEA) approach, was developed due to the realization that a pro-active approach to error control is necessary to identify potential errors. Table 2.1 shows only a portion of the taxonomy for the decision making component of the inspection task. The error taxonomy provided the analysts a systematic framework to suggest appropriate content for the **ASSIST** training program. The **ASSIST** training program specifically focused on the search and decision making components of the inspection task. These have also been shown to be determinants of inspection performance<sup>21,22</sup> and the two most critical tasks in aircraft inspection.<sup>2,3,23</sup> As an example, Table 2.2 shows how errors (see column 5) (identified from the error taxonomy – Table 2.1) for each subtask of the decision-making task (see column 1) were addressed by the specific modules of the **ASSIST** training program (see columns 2, 3, and 4). Column 2 specifies the training content, column 3 outlines the method used for training and column 4 specifies the specific training module within **ASSIST**. A detailed description of the **ASSIST** program follows.



**Table 2.1 Error Taxonomy for Decision Making in Aircraft Inspection**

TASK	ERRORS	OUTCOME
<b>4. DECISION</b>		
4.1 Interpret indication.	<ul style="list-style-type: none"> <li>Classify as wrong defect type.</li> </ul>	All indications located are correctly classified, correctly labeled as fault or no fault, and actions correctly planned for each indication.
4.2 Access comparison standard.	<ul style="list-style-type: none"> <li>Choose wrong comparison standards.</li> <li>Comparison standard not available.</li> <li>Comparison standard not correct.</li> <li>Comparison incomplete.</li> <li>Does not use comparison standard.</li> </ul>	
4.3 Decide on if fault.	<ul style="list-style-type: none"> <li>Type I error, false alarm.</li> <li>Type II error, missed fault.</li> </ul>	
4.4 Decide on action	<ul style="list-style-type: none"> <li>Choose wrong action.</li> <li>Second opinion if not needed.</li> <li>No second opinion if needed.</li> <li>Call for buy-back when not required.</li> <li>Fail to call for required buy-back.</li> </ul>	
4.5 Remember decision/action	<ul style="list-style-type: none"> <li>Forget decision/action.</li> <li>Fail to record decision/action.</li> </ul>	

**Table 2.2 Examples of Errors Addressed in the ASSIST Program**

TASK	CONTENT OF <b>ASSIST</b>	METHOD	PROGRAM MODULE	ERROR ADDRESSED FROM TASK ANALYSIS
<b>4 DECISION</b>				
4.1 Interpret indication	Present examples of defects and identify in simulator	Active and Feedback	General Module, Simulator	<ul style="list-style-type: none"> <li>Classify as wrong fault type</li> </ul>
4.2 Access comparison standard	Use simulator to access information on defects, locations, and action	Active and Feedback	General Module, Simulator	<ul style="list-style-type: none"> <li>Choose wrong comparison standards</li> <li>Comparison standard not available</li> <li>Comparison standard not correct</li> <li>Comparison incomplete</li> <li>Does not use comparison standard</li> </ul>
4.3 Decide on if it's a fault	Use simulator with real defects and feedback	Progressive parts, Active, and Feedback	Simulator	<ul style="list-style-type: none"> <li>Type I error, false alarm</li> <li>Type II error, missed fault</li> </ul>
4.4 Decide on action	Complete NR card with Feedback in correct way to fill out card	Active and Feedback	Simulator	<ul style="list-style-type: none"> <li>Choose wrong action</li> </ul>
4.5 Remember decision/action	Enter multiple defects and complete NR card with feedback	Active and Feedback	Simulator	<ul style="list-style-type: none"> <li>Forget decision/action</li> <li>Fail to record decision/action</li> </ul>

## X.3 AUTOMATED SYSTEM OF SELF-INSTRUCTION FOR SPECIALIZED TRAINING (**ASSIST**)

### X.3.1 System Specifications

**ASSIST** was developed using Visual Basic and Microsoft Access. The development work was conducted on a Pentium 120 MHz platform with a 17" high resolution monitor (0.28 mm dot pitch, non-interlaced), 32 MB RAM, 2 MB video RAM, ATI Mach 32 VLB advanced graphics accelerator card, 2GB Hard Drive, 36X-speed **CD-ROM** drive using a Reveal multimedia kit. The training program uses text, graphics, animation and audio. The inputs to the system are entered through a keyboard and a two-button mouse.

### X.3.2 System Structure

The overall structure of **ASSIST** is shown in Figure 3.1. **ASSIST** consists of three major modules: (1) General Inspection module, (2) Inspection Simulation Training module, and (3) Instructor's Utilities module. All system users interact through a user-friendly interface. The user interface capitalizes on graphical user interface technologies and human factors research on information presentation (e.g. color, formatting, layout, etc.), ease of use and information utilization.

### X.3.3 General Module

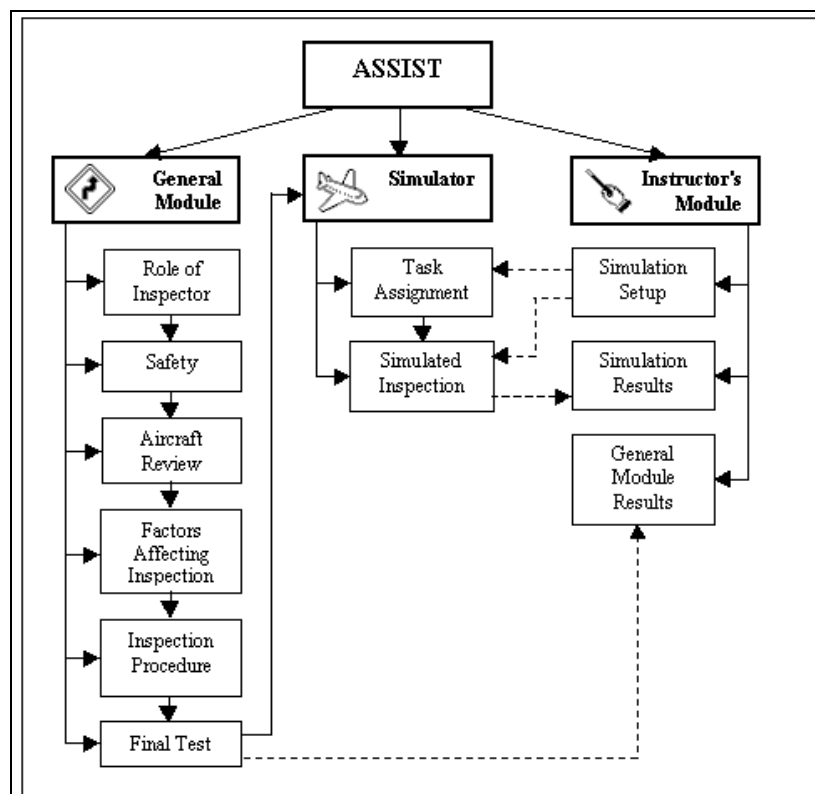
The objective of the general module is to provide the inspectors with a basic overview on the following topics: (1) role of the inspector, (2) safety, (3) types of aircraft, (4) factors affecting inspection performance, and (5) inspection procedure. The module incorporates multimedia (sound, graphic, text, pictures and video) with interaction opportunities between the user and the computer. Figure 3.2 shows a typical screen of the General inspection module.

### X.3.4 Inspection Simulation Training Module

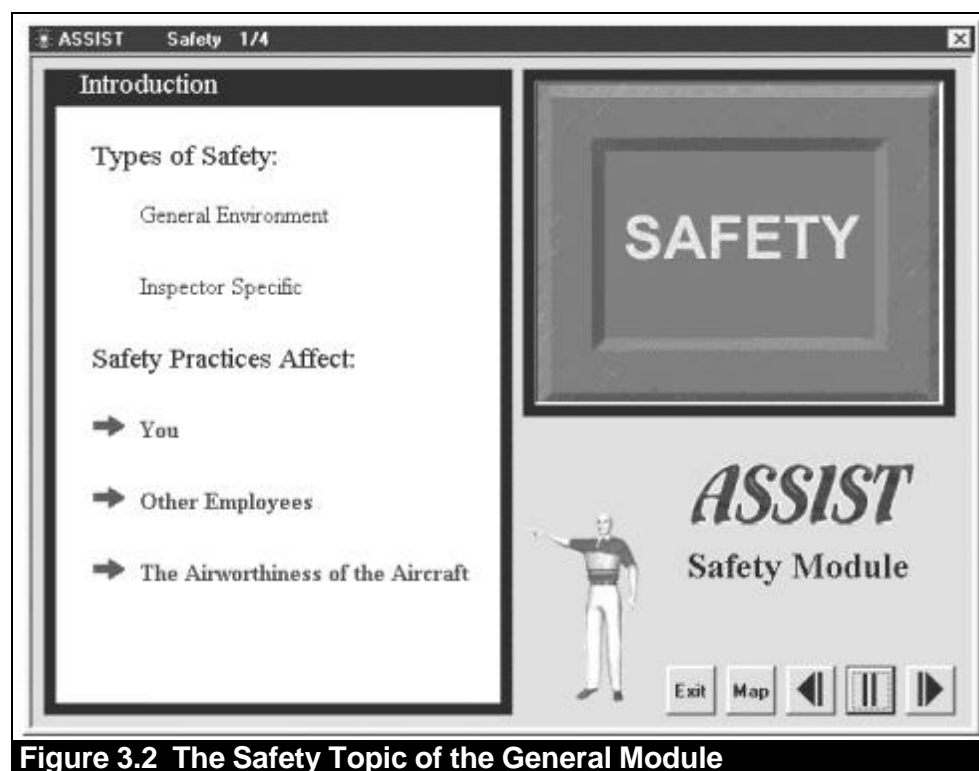
This module of the training program provides inspection training on a simulated aircraft inspection task (Aft Cargo Bin inspection of a Lockheed Martin L-1011) (Figure 3.3.). By manipulating the various task complexity factors the inspector can simulate different inspection scenarios. The simulation module uses actual photographs of the airframe structure with computer-generated defects.

Introduction The introduction provides the trainee with an overview of the various facets of the program, the work card for the inspection assignment and a graphic al representation of various faults. The section introduces the trainee to the search and decision making aspects of the visual inspection task.

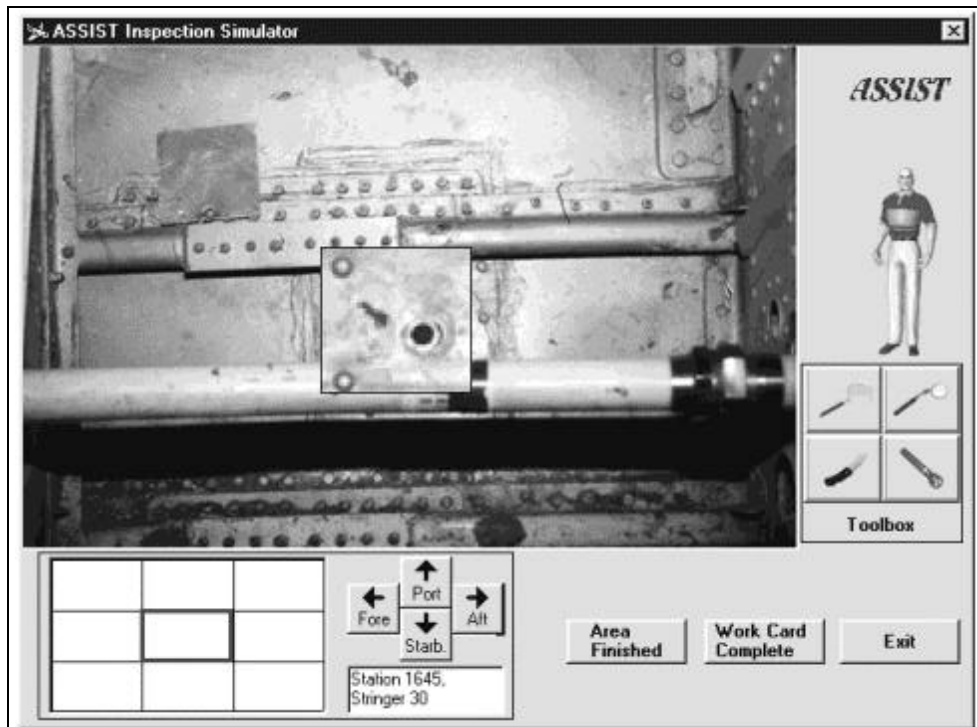




**Figure 3.1 Components of the ASSIST Aircraft Inspector Training Program**



**Figure 3.2 The Safety Topic of the General Module**



**Figure 3.3 The Inspection Simulator Showing the Use of the Magnifying Glass**

Testing The testing module is designed to operate in two separate modes: with and without feedback. The non-feedback mode simulates the actual visual inspection task as it would take place in the hangar. In either mode, the inspector first locates the defect and indicates this by clicking on the fault. Subsequently, the inspector classifies the defect. In the feedback mode, the inspector is provided with feedback on his/her performance on the search and decision making components of the inspection task. The trainee is also provided with end-of-session performance feedback. The program also features paced and unpaced modes. Paced mode allows the inspection to continue for only a specified period of time, while unpaced mode allows the inspection task to be unbounded by time.

### X.3.5 Instructor's Utilities Module

This module allows the supervisor/instructor to access the results database, the image database and the inspection parameter modules (Figure 3.4). The module is designed as a separate stand-alone tool that is linked to the other modules of the system. The results database allows the instructors to review the performance of a trainee who has taken several training and/or testing sessions. Performance data is stored on an individual image basis and summarized over the entire session so that results can be retrieved at either level. The utility allows the instructor to print or save the results to a file. The objective of the image database module is to provide the instructor with a utility wherein a specific image along with its associated information can be viewed on the computer screen. By manipulating the inspection parameters the instructor can create different inspection scenarios. The inspection parameter module allows the instructor to change the probability of defects, defect mix, the complexity of the inspection task, the information provided in the work card (thereby varying the feedforward information provided), whether

the inspection will work in feedback mode or non-feedback mode, and whether the inspection task is paced or unpaced.

**Instructor's Module**

**Overall Summary**

*ASSIST*

Select an Identification Number and Date: 9898 3/12/99 - 2

Number of Defects Present: 8

Visual: 4 Tool: 4

Number of Defects Correctly Detected: 3

Visual: 2 Tool: 1

Percentage of Defects Correctly Detected: 37.5%

Number of False Alarms: 1

Total Time to Complete Inspection: 1:47 (min:sec)

Print Results Save to Text File Overall Summary Scenario Image by Image Results Main Menu Exit

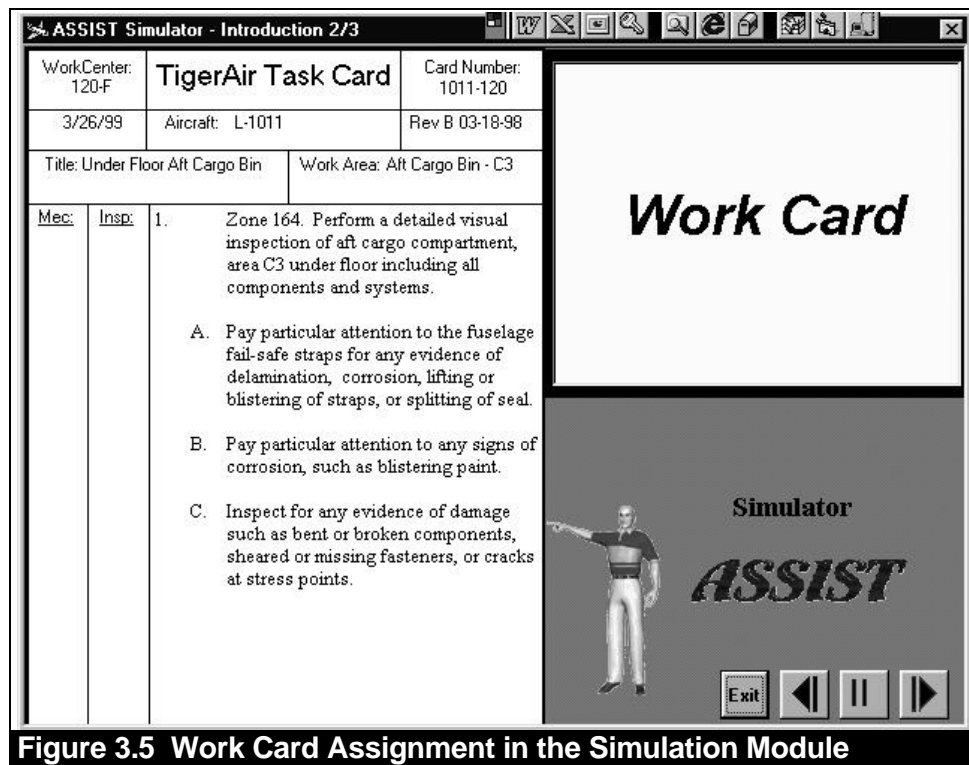
**Figure 3.4 The Simulator Results Section of the Instructor's Module**

### X.3.6 Inspection Training Session

The training program was designed to use the general principles listed earlier in the context of this particular inspection job as derived by the task analysis. A major prerequisite was that it be a progressive part training scheme which enabled the inspectors to build their repertoire of knowledge and skills in an orderly manner. A typical training session proceeds as follows:

1. **Initial Overview:** Initially the subjects use the introduction module, wherein they are introduced to the navigation map, and are familiarized with the operational aspects of the computer program.
2. **General Module Training:** In the general module the subjects are provided information on the following five topics relevant to an inspector: role of the inspector, safety, aircraft review, factors affecting inspection, and inspection procedures. Using the navigation map, the subjects can either directly go to a particular topic or sub-topic, or follow the default path through the topics. At the end of each topic, a brief quiz is administered to review the subject's understanding of the material. The subjects are provided feedback and correct answers supplied. On completion of the topics in the general module, the subjects take the final test. The final test consists of questions selected from a database and covers material from each topic within the general module.

3. **Simulation Module:** In the simulation module, subjects are initially introduced to the workings of the simulator. Following this step, the subjects are presented with a work card containing the instructions for the inspection assignment (Figure 3.5). Next, the subjects are provided with information on defect standards (Figure 3.6). This includes images of the defects, descriptions, likely locations for particular defects, and possible indicators. Following this step the subjects conduct inspection using representative images of airframe structures wherein they have to first search for the defect and later classify the defect as one necessitating maintenance action or not. The simulator allows the use of various inspection tools: mirror, flashlight, scraping knife, and magnifying glass to assist the subject in performing inspection (Figure 3.3). If a defect is found, subjects complete a discrepancy report. On completion of the task, subjects are provided with feedback on the overall performance. Feedback is provided on the subject's search and decision making performance (time to complete inspection, defect detection, defect classification performance, etc). The simulator can be operated in various modes (e.g., with or without feedback (Figure 3.7), paced or unpaced) and also allows the instructor to set various inspection parameters (e.g., mix of defects, defect probability, workcard instructions) thereby facilitating the creation of different inspection scenarios.



**Figure 3.5 Work Card Assignment in the Simulation Module**

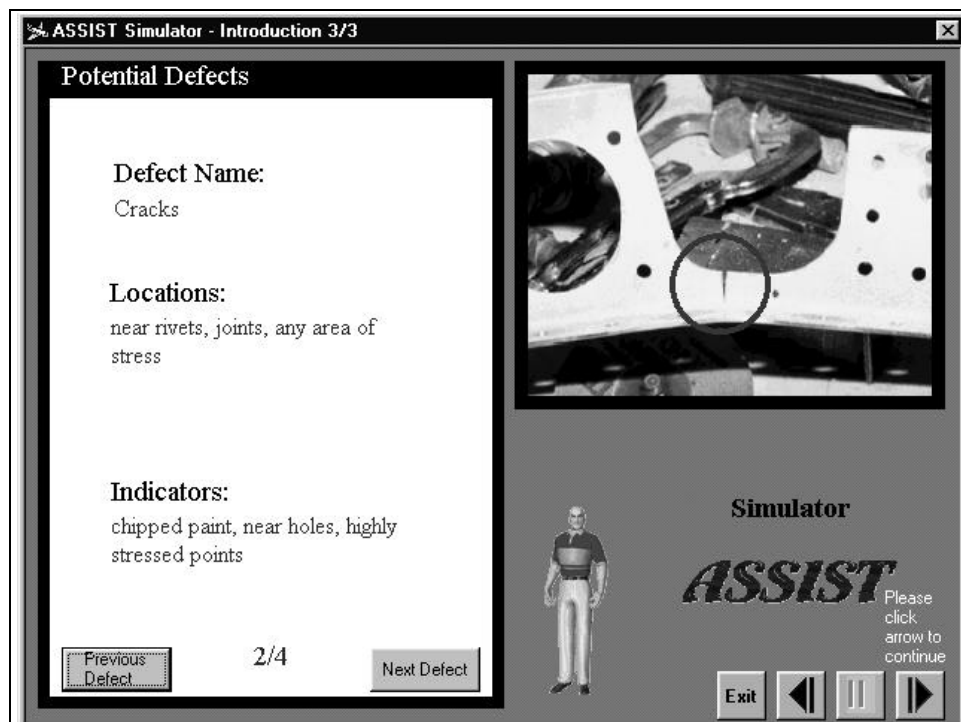


Figure 3.6 Defect Standards of Defects in the Simulated Inspection

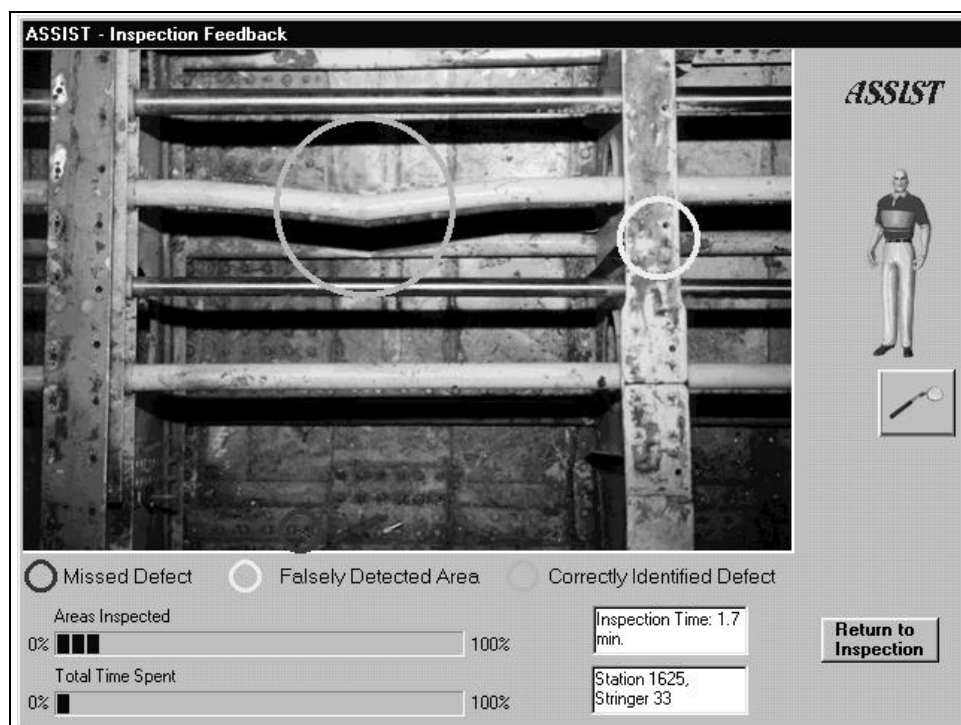


Figure 3.7 Screen by Screen Feedback in the Simulator When in Feedback Mode

## X.4 CONCLUSIONS AND EXTENSIONS

The high degree of control that **ASSIST** affords will create the opportunity to systematize the inspection training process. In addition, there are several other inherent advantages that will serve to alleviate the problems characteristic of **OJT**:

Completeness. Inspectors can be exposed to a wide variety of defects, with varying degrees of severity, at different locations, through the use of a library of defect images. Inspectors can also be trained on less frequently occurring critical defects.

Adaptability. **ASSIST** can be modified to meet the needs of individual inspectors. Batch files of images can be created to train inspectors on particular aspects of the inspection task with which they have the greatest difficulty. Thus, the program can be tailored to accommodate individual differences in inspection abilities.

Efficiency. Since the training will be more intensive, the trainees will be able to become more skilled within a shorter period of time.

Integration. The training system will integrate different training methods (e.g., feedback training, feed-forward training, and active training) into a single comprehensive training program.

Certification. **ASSIST** can be used as part of the certification process. Since the record keeping process can be automated, instructors can more easily monitor and track an individual's performance, initially for training and later for retraining.

Instruction. **ASSIST** could be used by instructors in **FAA** certified A&P schools for training. In this manner, for example, aircraft maintenance technicians could gain exposure to defects on wide-bodied aircraft that they might not have otherwise.

The report has described research in the area of aviation maintenance and inspection currently underway at Clemson University. Through the development and systematic application of human factors techniques, the research aims at improving the effectiveness and efficiency of aircraft visual inspection. The results of the research effort have been made available to the aviation maintenance community as deliverable products in the form of usable **CD-ROMs**. It is anticipated that the use of these products would lead to improved airworthiness of the U. S. domestic aircraft fleet. Subsequent phases of this research will evaluate the utility of **ASSIST** in an operational setting with aircraft inspectors. Finally, this research has future implications as well, the human performance models developed as part of the FY 97 activities could potentially be used in conjunction with **ASSIST** for a wide range of controlled studies. This would involve the evaluation of the effect of various task (e.g., pacing), subject (e.g., individual differences, fatigue) and environmental factors (e.g., noise and work interruptions) on aircraft inspection performance. Results forthcoming from this research would lead to the identification of specific interventions to enhance inspector performance and ultimately aviation safety.

## X.5 ACKNOWLEDGMENTS

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